

## General

### Guideline Title

Updated Society for Vascular Surgery guidelines for management of extracranial carotid disease.

### Bibliographic Source(s)

Ricotta JJ, AbuRahma A, Ascher E, Eskandari M, Faries P, Lal BK, Society for Vascular Surgery. Updated Society for Vascular Surgery guidelines for management of extracranial carotid disease. J Vasc Surg. 2011 Sep;54(3):e1-31. [280 references] [PubMed](#)

### Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Hobson RW 2nd, Mackey WC, Ascher E, Murad MH, Calligaro KD, Comerota AJ, et al. Management of atherosclerotic carotid artery disease: clinical practice guidelines of the Society for Vascular Surgery. J Vasc Surg 2008;48:480-6.

The Society for Vascular Surgery reaffirmed the currency of the guideline in April 2017.

This guideline meets NGC's 2013 (revised) inclusion criteria.

## Recommendations

### Major Recommendations

Definitions of the strength of the recommendations (Grade 1 or 2) and quality of the evidence (Level A–C) are provided at the end of the "Major Recommendations" field.

#### Recommendations for the Use of Carotid Bifurcation Imaging

Imaging of the cervical carotid artery is recommended in all patients with symptoms of carotid territory ischemia. This recommendation is based on the significant incidence of clinically relevant carotid stenosis in this patient group and the efficacy of carotid endarterectomy (CEA) for clinically significant lesions in reducing overall stroke (Grade 1, Level of Evidence A).

Imaging should be strongly considered for patients who present with amaurosis fugax, evidence of retinal artery embolization on fundoscopic examination, or asymptomatic cerebral infarction, and are candidates for CEA. This recommendation is based on the intermediate stroke risk in this group of patients and the efficacy of CEA in reducing risk of subsequent stroke (Grade 1, Level of Evidence A). Routine screening is *not recommended* to detect clinically asymptomatic carotid stenosis in the

general population. Screening is *not recommended* for presence of a neck bruit alone without other risk factors. This recommendation is based on the low prevalence of disease in the population at large, including those with neck bruits, as well as the potential harm of indiscriminate application of carotid bifurcation intervention to a large number of asymptomatic individuals (Grade 1, Level of Evidence A).

Screening for asymptomatic clinically significant carotid bifurcation stenosis should be considered in certain groups of patients with multiple risk factors that increase the incidence of disease as long as the patients are fit for and willing to consider carotid intervention if a significant stenosis is discovered. The presence of a carotid bruit in these patients increases the likelihood of a significant stenosis (Grade 1, Level of Evidence B). Such groups of patients include:

- Patients with evidence of clinically significant peripheral vascular disease regardless of age.

- Patients aged  $\geq 65$  years with a history of one or more of the following atherosclerotic risk factors: coronary artery disease (CAD), smoking, or hypercholesterolemia. In general, the more risk factors present, the higher the yield of screening should be expected.

Carotid screening may be considered in patients before coronary artery bypass grafting (CABG). This is most likely to be fruitful if the patients are aged  $>65$  years and have left main disease or a history of peripheral vascular disease. The strongest indication for screening these patients from the data available is to identify patients at high risk for perioperative stroke (Grade 2, Level of Evidence B).

Carotid screening is *not recommended* for patients with abdominal aortic aneurysm (AAA) who do not fit into one of the above categories (Grade 2, Level of Evidence B).

Carotid screening is *not recommended* for asymptomatic patients who have undergone prior head and neck radiotherapy. Although the incidence of disease is increased in this group of patients, the utility of intervention in the absence of neurologic symptoms has not been clearly established (Grade 2, Level of Evidence B).

#### Recommendations for Selection of Carotid Imaging Modalities

Carotid duplex ultrasound (CDUS) in an accredited vascular laboratory is the initial diagnostic imaging of choice for evaluating the severity of stenosis in symptomatic and asymptomatic patients. Unequivocal identification of stenosis of 50% to 99% in neurologically symptomatic patients or 70% to 99% in asymptomatic patients is sufficient to make a decision regarding intervention (Grade 1, Level of Evidence A).

CDUS in an accredited vascular laboratory is the imaging modality of choice to screen asymptomatic populations at high risk (Grade 1, Level of Evidence B).

When CDUS is nondiagnostic or suggests stenosis of intermediate severity (50% to 69%) in an asymptomatic patient, additional imaging with magnetic resonance angiography (MRA), computed tomography angiography (CTA) or digital subtraction angiography (DSA) is required before embarking on any intervention (Grade 1, Level of Evidence B).

When evaluation of the vessels proximal or distal to the cervical carotid arteries is needed for diagnosis or to plan therapy, imaging with CTA, MRA, or catheter angiography in addition to CDUS is indicated. CTA is preferable to magnetic resonance imaging (MRI) or MRA for delineating calcium. When there is discordance between two minimally invasive imaging studies (CDUS, MRA, CTA), DSA is indicated to resolve conflicting results. DSA is generally reserved for situations where there is inconclusive evidence of stenosis on less invasive studies or when carotid artery stenting (CAS) is planned (Grade 1, Level of Evidence B).

A postoperative duplex ultrasound (DUS) study  $\leq 30$  days is recommended to assess the status of the endarterectomized vessel. In patients with  $\geq 50\%$  stenosis on this study, further follow-up imaging to assess progression or resolution is indicated. In patients with a normal DUS study result and primary closure of the endarterectomy site, ongoing imaging is recommended to identify recurrent stenosis. In patients with a normal DUS after patch or eversion endarterectomy, further imaging of the endarterectomized vessel may be indicated if the patient has multiple risk factors for progression of atherosclerosis. There are insufficient data to make recommendations on imaging after CAS (Grade 2, Level of Evidence C). Although the data in this area are not robust concerning intervals for follow-up imaging, the committee was unanimous in this recommendation, recognizing

that follow-up DUS carries little risk.

Imaging after CAS or CEA is indicated to monitor contralateral disease progression in patients with contralateral stenosis  $\geq 50\%$ . In patients with multiple risk factors for vascular disease, follow-up DUS may be indicated with lesser degrees of stenosis. The likelihood of disease progression is related to the initial severity of stenosis (Grade 2, Level of Evidence C). Although the data in this area are not robust concerning intervals for follow-up imaging, the committee was unanimous in this recommendation, recognizing that follow-up DUS carries little risk.

#### Recommendations for Medical Management of Patients with Carotid Atherosclerosis

In patients with carotid artery stenosis, treatment of hypertension, hypercholesterolemia, and efforts at smoking cessation are recommended to reduce overall cardiovascular risk and risk of stroke regardless of whether intervention is planned. Targets are those defined by the National Cholesterol Education Program guidelines (Grade 1, Level of Evidence A).

Aggressive treatment of hypertension in the setting of acute stroke is *not recommended*; however, treatment of hypertension after this period has passed is associated with reduced risk of subsequent stroke. The target parameters are not well defined (Grade 1, Level of Evidence C).

Treatment of diabetes with the goal of tight glucose control has not been shown to reduce stroke risk or decrease complication rates after CEA and is *not recommended* for these purposes (Grade 2, Level of Evidence A).

Anticoagulation is *not recommended* for the treatment of transient ischemic attack (TIA) or acute stroke, unless there is evidence of a cardioembolic source (Grade 1, Level of Evidence B).

Antiplatelet therapy in asymptomatic patients with carotid atherosclerosis is recommended to reduce overall cardiovascular morbidity, although it has not been shown to be effective in the primary prevention of stroke (Grade 1, Level of Evidence A).

Antiplatelet therapy is recommended for secondary stroke prevention: aspirin, aspirin combined with dipyridamole, and clopidogrel are all effective. Clopidogrel combined with aspirin is not more effective than either drug alone (Grade 1, Level of Evidence B).

Perioperative medical management of patients undergoing carotid revascularization should include blood pressure control ( $<140/80$  mm Hg),  $\beta$ -blockade (heart rate, 60-80 beats/min), and statin therapy (low-density lipoprotein [LDL]  $<100$  mg/dL) (Grade 1, Level of Evidence B).

Perioperative antithrombotic therapy for CEA should include aspirin (81-325 mg) (Grade 1, Level of Evidence A). The use of clopidogrel in the perioperative period should be decided case-by-case (Grade 2, Level of Evidence B).

Perioperative antithrombotic management of CAS patients should include dual-antiplatelet therapy with aspirin and ticlopidine or clopidogrel. Dual-antiplatelet therapy should be initiated at least 3 days before CAS and continued for 1 month, and aspirin therapy should be continued indefinitely (Grade 1, Level of Evidence C).

#### Recommendations Regarding CEA and CAS Technique

Patch angioplasty or eversion endarterectomy are recommended rather than primary closure to reduce the early and late complications of CEA (Grade 1, Level of Evidence A).

Use of an embolic protection device (proximal or distal occlusion, distal filter) is recommended during CAS to reduce the risk of cerebral embolization (Grade 1, Level of Evidence B).

#### Recommendations for Selecting Therapy

For neurologically symptomatic patients with stenosis  $<50\%$  or asymptomatic patients with stenosis  $<60\%$  diameter reduction, optimal medical therapy is indicated. There are no data to support CAS or CEA in this patient group (Grade 1, Level of Evidence B).

In most patients with carotid stenosis who are candidates for intervention, CEA is preferred to CAS for reduction of all-cause stroke and periprocedural death (Grade 1, Level of Evidence B). Data from the Carotid Revascularization Endarterectomy versus Stenting Trial (CREST) suggest that patients aged  $<70$  years may be better treated by CAS, but these data need further confirmation.

Neurologically asymptomatic patients with  $\geq 60\%$  diameter stenosis should be considered for CEA for

reduction of long-term risk of stroke, provided the patient has a 3- to 5-year life expectancy and perioperative stroke/death rates can be  $\leq 3\%$  (Grade 1, Level of Evidence A).

CEA is preferred over CAS in patients aged  $>70$  years of age, with long ( $>15$ -mm) lesions, preocclusive stenosis, or lipid-rich plaques that can be completely removed safely by a cervical incision in patients who have a virgin, nonradiated neck (Grade 1, Level of Evidence A).

CAS is preferred over CEA in *symptomatic* patients with  $\geq 50\%$  stenosis and tracheal stoma, situations where local tissues are scarred and fibrotic from prior ipsilateral surgery or external beam radiotherapy, prior cranial nerve injury, and lesions that extend proximal to the clavicle or distal to the C2 vertebral body (Grade 2, Level of Evidence B). CEA may be preferable in situations where ipsilateral tissue planes remain relatively intact.

CAS is preferred over CEA in *symptomatic* patients with  $\geq 50\%$  stenosis and severe uncorrectable CAD, congestive heart failure, or chronic obstructive pulmonary disease (Grade 2, Level of Evidence C). In making this a Grade 2 recommendation, the committee recognized the difficulty in clearly defining this group of individuals, both in symptomatology and risk assessment, and acknowledged the potential increased role of aggressive medical management as primary therapy in this high-risk group.

Neurologically asymptomatic patients deemed "high risk" for CEA should be considered for primary medical management. CEA can be considered in these patients only with evidence that perioperative morbidity and mortality is  $<3\%$ . CAS should not be performed in these patients except as part of an ongoing clinical trial (Grade 1, Level of Evidence B).

There are insufficient data to recommend CAS as primary therapy for neurologically asymptomatic patients with 70% to 99% diameter stenosis. Data from CREST suggest that in properly selected asymptomatic patients, CAS is equivalent to CEA in the hands of experienced interventionalists. Operators and institutions performing CAS must exhibit expertise sufficient to meet the previously established American Heart Association (AHA) guidelines for treatment of patients with asymptomatic carotid stenosis. Specifically, the combined stroke and death rate must be  $<3\%$  to ensure benefit for the patient (Grade 2, Level of Evidence B).

## Recommendations for Management of Acute Neurologic Syndromes

Patients who present  $\leq 6$  hours of the onset of stroke should be considered for acute intervention to reduce the ultimate neurologic deficit. Interventions may include local or systemic thrombolysis (Grade 1, Level of Evidence A). The role of endoluminal mechanical lysis or extraction remains to be defined.

Patients who present with fixed neurologic deficit  $>6$  hours' duration should be considered for CEA once their condition has been stabilized. CEA should be performed  $\leq 2$  weeks of the neurologic event (Grade 1, Level of Evidence B).

Patients who present with repetitive (crescendo) episodes of transient cerebral ischemia unresponsive to antiplatelet therapy should be considered for urgent CEA. The risk of intervention is increased over elective surgery for neurologic symptoms, but not as much as for patients with stroke in evolution. CEA is preferred to CAS in these patients based on the presumptive increased embolic potential of bifurcation plaque in this clinical situation (Grade 1, Level of Evidence C).

For acute stroke after CEA, emergent imaging (ultrasound or fast CTA) is indicated to evaluate the endarterectomy site. When imaging suggests thrombosis, is indeterminate, or not available, immediate operative re-exploration is indicated (Grade 1, Level of Evidence B).

When the endarterectomy site is patent, other modalities such as computed tomography (CT) and angiography should be used to better identify the cause of the stroke. If CT excludes intracranial hemorrhage, anticoagulation is reasonable until a definitive decision regarding the appropriate diagnosis and therapy can be made (Grade 2, Level of Evidence C). The committee acknowledged the lack of robust data in this small group of patients but was unanimous in its endorsement of this recommendation based on the data available and the low likelihood that new data would emerge in the near future.

No firm recommendations can be made on treatment of stent thrombosis associated with CAS. It is reasonable to attempt to restore patency by use of chemical lysis or clot extraction (Grade 2, Level of Evidence C). The committee acknowledged the lack of robust data in this small group of patients

but was unanimous in its endorsement of this recommendation based on the data available and the low likelihood that new data would emerge in the near future.

#### Recommendations for Management of Symptomatic Internal Carotid Artery (ICA) Occlusion

Patients with known ICA occlusion and persistent ipsilateral neurologic symptoms can be treated by endarterectomy of the common and external carotid artery, with transection and ligation of the ICA origin. The addition of oral anticoagulation is likely to reduce the rate of recurrent CVA (Grade 1, Level of Evidence C).

#### Recommendations for Management of Carotid Dissection

Patients with carotid dissection should be initially treated with antithrombotic therapy (antiplatelet agents or anticoagulation) (Grade 1, Level of Evidence C).

Patients who remain symptomatic on medical therapy may be considered for intervention. Although data are insufficient to make firm recommendations, the committee unanimously agreed that balloon angioplasty and stenting is currently preferred over open surgery after failed medical management (Grade 2, Level of Evidence C).

#### Recommendations for Management of Combined Carotid and Coronary Disease

Patients with symptomatic carotid stenosis will benefit from CEA before or concomitant with CABG. The timing of the intervention depends on clinical presentation and institutional experience (Grade 1, Level of Evidence B).

Patients with severe bilateral asymptomatic carotid stenosis, including stenosis and contralateral occlusion, should be considered for CEA before or concomitant with CABG (Grade 2, Level of Evidence B).

#### Definitions:

##### Strength of Recommendation

Grade 1 recommendations ("strong") are those in which the benefits of an intervention clearly outweigh its risk and burdens. All well-informed patients would choose such a treatment, and the physician can securely recommend it without a detailed knowledge of the underlying data.

Grade 2 recommendations ("weak") are weaker and reflect therapies where the benefits and risks are uncertain or are more closely balanced. For such interventions, patients may choose different options based on their underlying values.

##### Ratings of the Quality of Evidence

Quality of Evidence	Rating	Description
High	A	Further research unlikely to change confidence in estimate of effect.
Moderate	B	Further research likely to impact confidence in estimate of effect and may change estimate.
Low	C	Further research very likely to impact confidence in estimate of effect and likely to change estimate.

## Clinical Algorithm(s)

None provided

## Scope

# Disease/Condition(s)

Extracranial carotid artery disease (carotid artery stenosis)

## Guideline Category

Diagnosis

Management

Prevention

Risk Assessment

Screening

Treatment

## Clinical Specialty

Cardiology

Internal Medicine

Neurological Surgery

Neurology

Radiology

Surgery

## Intended Users

Physicians

## Guideline Objective(s)

To update and expand the 2008 guidelines for treatment of carotid artery disease with specific emphasis on six areas:

- Imaging in identification and characterization of carotid stenosis

- Medical therapy (as stand-alone management and also in conjunction with intervention in patients with carotid bifurcation stenosis)

- Risk stratification to select patients for appropriate interventional management (carotid endarterectomy [CEA] or carotid artery stenting [CAS])

- Technical standards for performing CEA and CAS

- The relative roles of CEA and CAS

- Management of unusual conditions associated with extracranial carotid pathology

## Target Population

Patients with extracranial carotid artery disease (carotid artery stenosis), including neurologically symptomatic and neurologically asymptomatic patients

## Interventions and Practices Considered

1. Use of carotid bifurcation imaging for screening for carotid stenosis in selected patient groups based on risk factors (routine screening is not recommended to detect clinically asymptomatic carotid stenosis in the general population)
2. Selection of carotid artery imaging modalities
  - Carotid duplex ultrasound (CDUS)
  - Magnetic resonance angiography (MRA)
  - Computed tomography angiography (CTA)
  - Digital subtraction angiography (DSA)
  - Postoperative duplex ultrasound (DUS) studies
3. Medical management of patients with carotid atherosclerosis
  - Treatment of hypertension (aggressive treatment not recommended)
  - Treatment of hypercholesterolemia
  - Smoking cessation
  - Treatment of diabetes (not recommended for these purposes)
  - Antiplatelet and antithrombotic therapy
  - Anticoagulant therapy (not recommended routinely)
4. Carotid endarterectomy (CEA) and carotid artery stenting (CAS) techniques
  - Patch angioplasty or eversion endarterectomy rather than primary closure
  - Use of an embolic protection device (proximal or distal occlusion, distal filter) during CAS
5. Selection of therapy (medical management, CEA, CAS) based on patient characteristics
6. Management of acute neurologic syndromes
7. Management of symptomatic internal carotid artery (ICA) occlusion
8. Management of carotid dissection
9. Management of combined carotid and coronary artery disease (timing of coronary artery bypass grafting [CABG])

## Major Outcomes Considered

- Death
- Incidence of nonfatal stroke
- Incidence of nonfatal myocardial infarction

## Methodology

### Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

### Description of Methods Used to Collect/Select the Evidence

#### 2011 Guideline

A systematic review was conducted in July 2010 to support development of an update of the 2008 guidelines by the Society for Vascular Surgery (see the "Availability of Companion Documents" field).

Studies that enrolled patients with carotid artery disease regardless of symptoms and allocated them at random to either carotid artery endarterectomy or to endovascular treatment (stenting) were eligible for review. Studies were included regardless of size or language of publication. Included studies had to measure the outcomes of interest (stroke, death, or myocardial infarction).

A comprehensive literature search of electronic databases (MEDLINE, EMBASE, Web of Science, and Cochrane CENTRAL) was conducted from 2008 through July 2010 using the appropriate terms and text words. Trials published before 2008 were obtained from the Guideline Committee's previous systematic review. The details of the search strategy are available from the authors upon request. In brief, reviewers modified the strategy used in the previous systematic review. The primary concept was treatment of carotid artery stenosis – MeSH and EMBASE both use the subject heading of Carotid Stenosis with the subheadings of surgery or therapy. The specific subject heading for Carotid Endarterectomy, and the keywords carotid within 4 words of endarterectomy, or the keyword endovasc\$ was matched against stent\$, and then filtered for clinical trials using the Haynes filter. CENTRAL uses an abbreviated form of the search strategy, since inclusion in the database requires the articles to be clinical trials.

Two reviewers, working independently determined trial eligibility, and extracted descriptive, methodologic, and outcome data from each eligible randomized controlled trial (RCT).

#### 2016 Reaffirmation

A literature search of electronic databases (MEDLINE, EMBASE, Scopus, and Web of Science) was conducted from January 1, 1946 through January 7, 2017 using the terms "Carotid Stenosis, Endarterectomy, Carotid, exp carotid arteries, exp angioplasty, angioplast, stent, randomized controlled trial.pt., controlled clinical trial.pt., randomized controlled trials/, random allocation, double blind method." Randomized controlled trials comparing carotid endarterectomy vs. carotid stenting in symptomatic and asymptomatic patients were included. Non-original research, non-randomized trials, and non-published abstracts were excluded.

## Number of Source Documents

#### 2011 Guideline

The original search identified 10 randomized controlled trials (RCTs). The updated search identified 418 potentially eligible references, of which only three new RCTs were identified. Thus, the total body of evidence included 13 RCTs enrolling 7484 patients; of which 4302 (57%) were participants of the three new RCTs. One of these three trials is a long-term update of a previously published preliminary report.

#### 2016 Reaffirmation

The search resulted in 547 abstracts that were reviewed manually resulting in 10 relevant new studies (4 were long term follow up from previously published trials).

## Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

## Rating Scheme for the Strength of the Evidence

Ratings of the Quality of Evidence

Quality of Evidence	Rating	Description
High	A	Further research unlikely to change confidence in estimate of effect.
Moderate	B	Further research likely to impact confidence in estimate of effect and may change estimate.
Low	C	Further research very likely to impact confidence in estimate of effect and likely to change estimate.



# Methods Used to Analyze the Evidence

Meta-Analysis of Randomized Controlled Trials

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

## Description of the Methods Used to Analyze the Evidence

### 2011 Guideline

A systematic review was conducted in July 2010 to support development of an update of the 2008 guidelines by the Society for Vascular Surgery (see the "Availability of Companion Documents" field).

Random-effects meta-analysis was used to assess relative risks and the  $I^2$  statistic was used to assess heterogeneity of treatment effect among trials. The  $I^2$  statistic represents the proportion of heterogeneity of treatment effect across trials that were not attributable to chance or random error. Hence, a value  $>50\%$  reflects significant heterogeneity that is due to real differences in study populations, protocols, interventions, and outcomes. The three main patient-important outcomes of interest were death, stroke, and myocardial infarction (MI) measured at the longest follow-up. The Reviewers did not use a composite endpoint of these vascular morbidities because the results of published trials violated the assumptions of a common underlying treatment effect needed for proper interpretation of composite endpoints (i.e., death, MI, and stroke, the components of the composite endpoints responded to the intervention in different directions). Intention to treat analyses data were extracted whenever possible. Absolute effects were estimated using pooled relative risks and median control event rates from patients undergoing carotid endarterectomy in the included trials.

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework was used to determine the quality of evidence. Subgroup analyses that were established a priori and conducted in the original meta-analysis were repeated (subgroups based on the patients' symptoms, the use of protective devices, and stopping trials prematurely). Two older randomized controlled trials (RCTs) were excluded in sensitivity analysis in which the interventions may be deemed less relevant to current practice (Carotid and Vertebral Artery Transluminal Angioplasty Study [CAVATAS] in which only 26% of patients received stents; and Leicester in which there was no preprocedural imaging of the origin of the major head and neck vessels to exclude contraindications to carotid artery stenting [CAS], use of nondedicated stents, and lack of routine predilation techniques).

### 2016 Reaffirmation

The original systematic review identified 13 eligible trials. The new literature showed results that are narratively and qualitatively consistent with prior evidence (i.e., noninferiority of stenting in most cases with slightly lower mortality and periprocedure myocardial infarction, with endarterectomy showing lower incidence of neurologic outcomes such as stroke, transient ischemic stroke [TIA], silent stroke).

## Methods Used to Formulate the Recommendations

Expert Consensus

## Description of Methods Used to Formulate the Recommendations

### 2011 Guideline

In developing these recommendations, the committee placed more weight on the reduction of stroke and death and less on the importance of nonfatal myocardial infarction (MI). Because the latter end point

often represents the main benefit of carotid artery stenting (CAS), the recommendations in the original guideline document are more circumspect with regard to the role of CAS and more supportive of the role of carotid endarterectomy (CEA) than the recommendations of the American Heart Association (AHA) guidelines committee.

The committee reviewed the literature pertinent to each of six areas and provided recommendations for treatment using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system. This system, adopted by more than 40 other organizations, incorporates an evaluation of the strength of the evidence and the risks/benefits of implementing the recommendation. For the purposes of this review, the committee placed the highest priorities on reducing overall stroke risk, periprocedural stroke risk, and periprocedural mortality. Lesser importance was given to reducing nonfatal MI, cost, and the ability to perform a percutaneous procedure.

Recommendations are characterized as *strong* GRADE 1 or *weak* GRADE 2, based on the quality of evidence, the balance between desirable effects and undesirable ones, the values and preferences, and the resources and costs (see the "Rating Scheme for the Strength of the Recommendations" field).

In addition to the GRADE of recommendation, the level of evidence to support the recommendation is noted. Evidence is divided into 3 categories: A (high quality), B (moderate quality), and C (low quality) (see the "Rating Scheme for the Strength of the Evidence" field). It is important to note that a GRADE 1 recommendation can be made based on low-quality (C) evidence by the effect on patient outcome. For example, although there are little data on the efficacy of CEA in asymptomatic patients with <60% stenosis, one can recommend with confidence that CEA not be performed in these patients. A full explanation of the GRADE system is presented in the recent article by Murad et al. (see the "Availability of Companion Documents" field). It is important to note that this grading system differs somewhat from the one used in the recent American College of Cardiology (ACC)/AHA Task force report.

Each member of the Guideline Committee was assigned responsibility for compiling information pertinent to a specific area of the document. These data were distributed to all members for review, and each area was subsequently discussed in conference calls. A consensus of the recommendation and level of evidence to support it was reached. Each recommendation in this document represents the unanimous opinion of the task force. Although some recommendations are GRADE 2 with Level 3 data, the task force felt it appropriate to present these as the unanimous opinion of its members regarding optimal current management. This was done with the recognition that such recommendations could change in the future but that it was unlikely that new data would emerge soon. These guidelines are likely to be a "living document" that will change as techniques are further refined, technology develops, medical therapy improves, and new data emerge.

#### 2016 Reaffirmation

The methodology group shared its findings with the SVS Document Oversight Committee Chair and the Guidelines Writing Group Chair who determined these findings do not warrant an update to the guideline.

## Rating Scheme for the Strength of the Recommendations

### Strength of Recommendation

Grade 1 recommendations ("strong") are those in which the benefits of an intervention clearly outweigh its risk and burdens. All well-informed patients would choose such a treatment, and the physician can securely recommend it without a detailed knowledge of the underlying data.

Grade 2 recommendations ("weak") are weaker and reflect therapies where the benefits and risks are uncertain or are more closely balanced. For such interventions, patients may choose different options based on their underlying values.

## Cost Analysis

The guideline developers reviewed published cost analyses.

## Method of Guideline Validation

Internal Peer Review

## Description of Method of Guideline Validation

The Document Oversight Committee of the Society for Vascular Surgery (SVS) conducts peer reviews of the guidelines documents. This committee consists of a panel of eight experts not involved in the aforementioned steps. Committee members who participated in writing the guidelines manuscript are excused from the review process.

## Evidence Supporting the Recommendations

### Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

Appropriate management of patients with extracranial carotid disease

### Potential Harms

- Hypertension is a common comorbidity in patients undergoing carotid endarterectomy (CEA). Blood pressure fluctuations, both above and below normal, are a significant source of morbidity and may contribute to myocardial infarction (MI) and postoperative reperfusion syndrome. Careful periprocedural blood pressure management is critical to obtaining optimal results from the operation.
- Patients taking combined aspirin and clopidogrel therapy in the perioperative period have a 0.4% to 1.0% higher risk of major bleeding compared with aspirin alone. Aspirin therapy alone does not have to be discontinued before CEA. The risks of periprocedural MI from aspirin withdrawal outweigh the risk of fatal or severe bleeding from aspirin use.
- Compared with endarterectomy, carotid artery stenting (CAS) increases the risk of any stroke and decreases the risk of MI. Refer to the original guideline document and the accompanying systematic review and meta-analysis (see the "Availability of Companion Documents" field) for additional details on periprocedural and late complications associated with CEA and CAS.

## Qualifying Statements

### Qualifying Statements

Despite the challenges and inconsistent availability of high-quality evidence, the Society for Vascular

Surgery (SVS) maintains its effort to summarize, synthesize, and present all the available evidence, along with clear clinical practice recommendations, to help surgeons and their patients in decision making. Although the SVS uses state-of-the-art approaches, such as Grading of Recommendations, Assessment, Development and Evaluation framework (GRADE), innovations are needed to improve the quality of evidence in the field and to improve the clarity and usefulness of these guidelines, which will lead to increased confidence in the advice vascular surgeons provide to their patients. Given the limited quality of the evidence, the issues with generalizability, and the importance of patient values, practice guidelines should not be regarded as definitive or prescriptive. Consistent with the tenets of evidence-based medicine, they should be used to inform clinical decision making in the context of the physician's clinical expertise and the patient's underlying values and preferences.

## Implementation of the Guideline

### Description of Implementation Strategy

An implementation strategy was not provided.

## Institute of Medicine (IOM) National Healthcare Quality Report Categories

### IOM Care Need

Living with Illness

Staying Healthy

### IOM Domain

Effectiveness

Timeliness

## Identifying Information and Availability

### Bibliographic Source(s)

Ricotta JJ, AbuRahma A, Ascher E, Eskandari M, Faries P, Lal BK, Society for Vascular Surgery. Updated Society for Vascular Surgery guidelines for management of extracranial carotid disease. J Vasc Surg. 2011 Sep;54(3):e1-31. [280 references] [PubMed](#)

### Adaptation

Not applicable: The guideline was not adapted from another source.

### Date Released

2011 Sep (reaffirmed 2017 Apr 24)

## Guideline Developer(s)

Society for Vascular Surgery - Medical Specialty Society

## Source(s) of Funding

Society for Vascular Surgery

## Guideline Committee

Not stated

## Composition of Group That Authored the Guideline

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## Financial Disclosures/Conflicts of Interest

Committee members are required to provide a detailed, explicit description of their financial and intellectual conflicts of interest, consistent with the policies of the *Journal of Vascular Surgery*. Additional measures used to manage conflicts of interest include the multidisciplinary structure of guideline committees and the involvement of a methodology group in the evidence synthesis and guidelines integration.

Competition of interest: none.

## Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Hobson RW 2nd, Mackey WC, Ascher E, Murad MH, Calligaro KD, Comerota AJ, et al. Management of atherosclerotic carotid artery disease: clinical practice guidelines of the Society for Vascular Surgery. *J Vasc Surg* 2008;48:480-6.

The Society for Vascular Surgery reaffirmed the currency of the guideline in April 2017.

This guideline meets NGC's 2013 (revised) inclusion criteria.

## Guideline Availability

Electronic copies: Available from the [Journal of Vascular Surgery Web site](#) .

## Availability of Companion Documents

The following are available:

Murad MH, Shahrour A, Shah ND, Montori VM, Ricotta JJ. A systematic review and meta-analysis of randomized trials of carotid endarterectomy vs stenting. *J Vasc Surg*. 2011 Mar;53:792-7. Electronic

copies: Available from the [Journal of Vascular Surgery Web site](#) .

Murad MH, Montori VM, Sidawy AN, Ascher E, Meissner MH, Gloviczki P. Guideline methodology of the Society for Vascular Surgery including the experience with the GRADE framework. J Vasc Surg. 2011 May;53:1375-80. Electronic copies: Available from the [Journal of Vascular Surgery Web site](#) .

## Patient Resources

None available

## NGC Status

This NGC summary was completed by ECRI Institute on October 17, 2014. The information was verified by the guideline developer on November 18, 2014. The currency of the guideline was reaffirmed by the developer in April 2017 and this summary was updated by ECRI Institute on May 23, 2017.

## Copyright Statement

This NGC summary is based on the original guideline, which is subject to the guideline developer's copyright restrictions.

## Disclaimer

### NGC Disclaimer

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